MINISTRY OF TRANSPORTATION

RoadTalk

Ontario's Transportation Technology Transfer Digest • Summer 2007 • Vol 13 Issue 2

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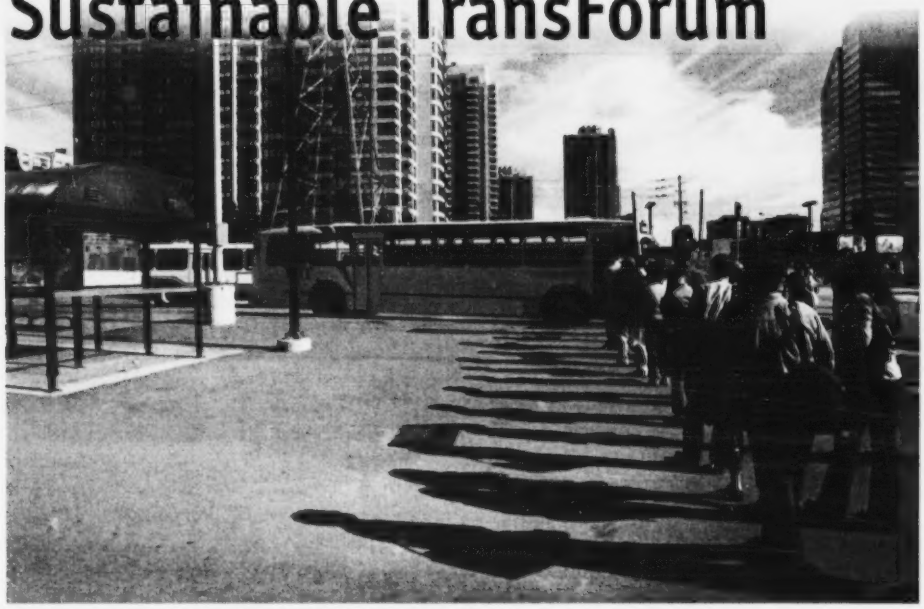
Ontario's Inaugural Sustainability Conference

Sustainable TransForum



Daily commuters line up to take public transit across the GTA.

On Monday, May 28th and Tuesday, May 29th, MTO hosted the first ever sustainable transportation conference in Ontario, the Sustainable TransForum. Speakers and thought leaders from across North America and Europe shared their knowledge of leading technologies, new innovations, and the latest research that supports sustainable transportation. In keeping with the sustainability theme, the conference was planned with a focus on resource conservation, efficiency, reduced consumption, and the maximum possible reuse and recycling.

"What we as a government have to do - and this is something we share with governments in almost every other jurisdiction in North America - is to find a way of integrating and promoting different transportation modes like air, rail, marine, road and transit so we can ease the strain on our roads and highways, and in the process ease the strain on our environment," said Minister of Transportation Donna Cansfield in her opening remarks. "Because in this day and age, we as a government, have a responsibility to be mindful of our effects on the environment and how we can minimize our impact."

Topics focused on the impacts of climate change, the future of transportation, the marketing of greener transportation, economic issues, accessibility, fuel efficiency, community planning, and sustainable development education.

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development considers the impact on the "triple-bottom-line:" Social, Economic, and Environmental (SEE) impacts. Technologies that support a "zero waste" approach will assist in meeting emission reduction standards while addressing SEE.

Current land use policies present a challenge as they focus on driving as the main mode of transportation. The high quantity of drivers contributes to problems associated with congestion, air quality, health, mobility for an aging population, and economic and climate change. City planning can become more sustainable by considering transit oriented development pedestrian and cycling access, parking policy, and protection of green spaces.

Marketing cities to families promotes ways to combat suburban sprawl and to lessen commuter distances required when families live in suburban areas. Promoting more active

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Technology Transfer is a communication process by which information, regarding an improvement in a product or method, is exchanged and implementation into practice is facilitated.

Ontario

> forms of transportation by developing walking or bike paths, installing bike racks on the front of buses and bike lockers at bus terminals also addresses air quality and health issues while reducing congestion.

"We need to give attractive alternatives, and that means a public transit system that is four things: accessible, convenient, reliable and safe," said Minister Cansfield.

With continued population growth - an expected 3.8 million more people in Ontario's Greater Golden Horseshoe area by 2031 - there is a greater need to educate the public on more sustainable practices. One way to do this is through school programs. There is a need for education on land use intensification and the benefits of raising children in more compact environments. The provincial "Places to Grow" Act provides guidelines for urban development in the Greater Golden Horseshoe.

Other practical solutions include carpooling and HOV lanes, transit investments, and complementary infrastructure such as cycling lanes and car-sharing programs in high-density areas. The first provincial HOV lanes have already been built on Highway 403 and Highway 404 to reduce emissions by encouraging carpooling and transit use. The Province of Ontario has further plans to add more than 450 km of new HOV lanes on 400-series highways.

Some specific topics discussed by speakers included:

- Many cities such as Vancouver, Portland, Denver, Berlin, and Minneapolis, promote sustainability through excellent bike networks. In Copenhagen, Denmark, 20% of capital is spent on biking infrastructure, and subsequently 40% of all trips in the city are made by bicycle.
- Transit organizations are now using the LEED process to make their operations more sustainable. LEED is the Leadership in Energy and Environmental Design green building rating system developed by the U.S. Green Building Council. Organizations can get points towards LEED certification by using recycled materials, low emission materials, local materials, and through the inclusion of green features such as green roofs. Transit organizations have followed these guidelines when renovating their building infrastructure to great success.
- E3 Fleet (Energy Environment Excellence) is modelled after LEED, a green building rating system for construction but adapted for use with commercial vehicle fleets. E3 Fleet has developed a green fleet action plan with a rating system to encourage both public and private sector fleets to increase fuel efficiency and reduce emissions and costs. There are sixteen participating groups since E3 Fleet launched in November 2006. The City of Hamilton is Canada's first green rated fleet. To meet the requirements, they decreased their greenhouse gas emissions by 2% and increased their fuel efficiency by 5% for every kilometre driven.
- Life cycle assessment (LCA) tools can be effective for guiding decisions to improve the environmental performance of transportation infrastructure. LCA is the analysis of the impacts of a given product throughout its lifetime. LCA tools can be used to evaluate the relative costs and benefits of the materials used.

"We need to give attractive alternatives, and that means a public transit system that is four things: accessible, convenient, reliable and safe," said Minister Cansfield.

- Environmentally friendly pavement practices include reusing and recycling materials to make roads that remain safe and durable while reducing emissions, energy use, and waste. Recycled pavement has performed well, carrying more traffic than anticipated. Ontario's Ministry of Transportation is a responsible contributor to the reduction of greenhouse gases and the improved quality of life. For example, since the implementation of CIR/CIREAM (cold in-place recycling/cold in-place recycled expanded asphalt mix) contracts, MTO has reduced CO_2 emissions by 54 thousand tonnes. CIR/CIREAM are two of the most environmentally friendly pavement rehabilitation techniques available [For more information on CIR/CIREAM, see the sidebar on page 8]. •

For more information, contact Louise Smith, Strategic Policy & Planning Office, at (416) 212-1933 or Louise.Smith@ontario.ca.

Heavy Lift

Island Park Bridges Rapid Replacement

For the first time, MTO is using rapid replacement technology to lift, remove and replace existing bridges. In August, MTO will be replacing the two bridges at Island Park on Highway 417. The full replacement will take approximately 15 hours.

Rapid replacement technology is a construction staging technique where a new structure is constructed in an enclosed area nearby. The existing structure will be removed, and the new structure placed using heavy lift technology. The rapid replacement technology to be utilized for moving the approximately 500-tonne bridges is Self Propelled Modular Transporters (SPMT). This technology has been used successfully in many bridge replacement projects in Europe and the United States in recent years.

Highway 417 (Ottawa Queensway) is the main east-west provincial corridor that accommodates a large volume of commuter traffic as well as serving substantial tourist and commercial inter-city and intra-city traffic from Ottawa. There are ten concrete deck/steel girder bridges along Highway 417 consisting of three or four traffic lanes (one bridge in both the eastbound and westbound directions). All ten of the bridges were constructed in 1959 and rehabilitated in 1983. During the planning phase, MTO revised the conventional construction approach to include utilizing the rapid replacement technology for all the deck/steel girder bridges, thus reducing traffic interruption.

SPMTs are very manoeuvrable equipment made up of modules with 4 to 6 axles and rubber tires that are able to turn 360 degrees. Depending on the load, as many modules can be added as needed and with so many wheels the actual load on the road surface is similar to that of a truck travelling on the highway. The SPMTs will be used to remove both the east- and westbound bridges and likewise the new bridges will be installed.

One project step included establishing a temporary enclosed construction staging area. This construction staging area accommodates the construction of the new Island Park bridge decks, and provides space for the placement of the existing bridges being removed. When the new bridges have been placed, the staging area will be used for the demolition of the existing bridges. The staging area site, used for only one construction season, will then be restored to preconstruction condition.

By adopting this innovative method of bridge replacement, the province is expecting to save about $2.4 million for the Island Park Bridges project by using rapid replacement and avoiding the typical lane closures associated with the conventional approach over a period of two construction seasons. Another advantage of this technology is the reduction of green house gases often caused by traffic congestion and car idling in a construction zone.

This project included extensive public consultation, traffic management and a risk assessment component as well as environmental consideration. The Ministry hopes the success of this project will result in rapid replacement technology being used in future bridge replacement projects in Ontario and across Canada. •

The old Island Park Bridge.

The new Island Park bridge deck under construction in the staging area.

For more information, contact
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Project website:
http://www.417queenswaybridges.ca/

Webcast of the construction:
http://www.islandparkcamera.com/

Technology Transfer links:
http://www.fhwa.dot.gov/BRIDGE/prefab/spmt.htm
http://www.fhwa.dot.gov/BRIDGE/prefab/index.htm

On Trial

Warm Asphalt Mix

Recognizing the impact that construction has on the environment, the construction industry has responded by developing a new approach to reduce their environment footprint. The traditional approach has been to produce asphalt mix at high temperatures resulting in heavy consumption of fuels and accompanying production of emissions. The new approach addresses this head on by producing the mix in a manner that uses less fuel, and produces fewer emissions.

Currently, asphalt mix is typically Hot Mix Asphalt (HMA). HMA is made by heating asphalt cement (AC) from a semi-solid state until it flows thinly enough to uniformly coat a mixture of aggregates. This process requires high temperatures in excess of 150° C to properly mix the materials and to ensure the mix is still workable when it is being placed and compacted on the road. This mixing process requires large quantities of energy and creates emissions. Warm Asphalt Mix (WMA) is an alternative method with benefits over HMA. WMA can be used with normal HMA materials and normal HMA mix designs using standard paving and compaction construction equipment.

WMA is produced at temperatures about 50° C lower than conventional HMA. Using less energy at lower temperatures during production results in up to a 50% drop in emissions. WMA claims to have the following benefits: its greater ability to be transported over long hauls; a quick opening to traffic; it can be placed in thinner lifts; and potentially could improve the performance of transverse and longitudinal joints. Performance of transverse and longitudinal joints depends on the ability to obtain good compaction along the supported edges. Mix freshly placed against the adjacent previously placed WMA re-heats the mix, allowing construction rollers to further compact the joint and push the mix into the existing joint. This may lead to better joint performance. WMA could also allow construction under cooler weather conditions extending the paving season.

Other benefits of using Warm Asphalt include reduced exposure to fumes for workers during placement and compaction of the WMA. Also lower production temperatures reduces short-term aging of AC which allows for longer hauling distance of the mixture between mixing plant and construction site. Further evaluation is still needed to determine the performance of WMA, impact of the moisture in the mix, potential softness and rutting of the pavement, sustainability of the asphalt as well as the skid resistance, etc. especially for heavily trafficked roads.

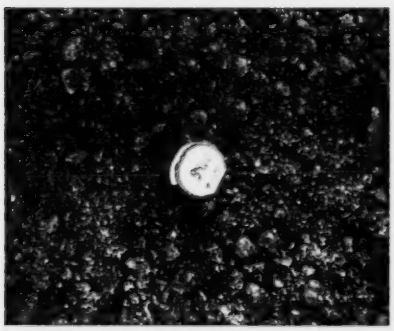
Warm Asphalt Mix can be produced through a number of different methods. The process that MTO was first introduced to, and is incorporating in its trials is Mead Westvaco's Evotherm technology. Evotherm WMA technology uses a high AC residue emulsion. Evotherm is an innovative chemical additive technology that has been shown to be constructible with mix and compaction temperatures as low as 60° Celsius.

On April 23, MTO staff from both Regional and Head Offices attended a morning presentation of another WMA technology called Sasobit, which incorporates a wax additive blown into the mix. About a month later, a third presentation was given covering the Aspha-Min WMA technology which involves the addition of aspha-min or zeolite which releases moisture in the mix to improve the workability of the mix at the lower temperatures.

An Evotherm WMA Trial was placed in the Fall of 2005 on a municipal road near Brechin, Ontario. The trial was observed by MTO to check emission testing and mix temperatures at the Hot Mix Asphalt plant as well as the construction site paving operation. Based on the positive observations made at that time, MTO scheduled a WMA trial to be constructed on a section of Highway 15 from Smiths Falls Northerly up to Franktown. MTO schedules and conducts trials to keep abreast of technology.

With the commitment to reduce the impact of highway construction on the environment and the potential of WMA will assist us in this endeavour, MTO is likely to schedule more trials in the future using some of the other WMA technologies. ●

For more information, contact Pamela Marks, Materials Engineering and Research Office, at (416) 235-3724 or Pamela.Marks@ontario.ca or Kai Tam, Materials Engineering and Research Office, at (416) 235-3725 or Kai.Tam@ontario.ca.



Temperature of Warm Asphalt was ~95° C after production trial.

Drainage Pipes

Sliplining Culvert Rehabilitation

Since 1995, MTO has made use of innovative sliplining technology to rehabilitate drainage pipes. Sliplining culverts (SLC) reduce the need for open trench construction and costly road closures by relining the deteriorated portion of a culvert with inserted liners/pipes that meet or exceed MTO material standards. In the past, reinforcing existing culverts has saved the ministry between 30 to 50 percent in direct and indirect costs, yielded a greater degree of accuracy for total project cost estimates and provides an environmentally sensitive alternative to open cut construction.

A culvert is traditionally defined as a pipe that conveys surface water or air through an embankment. It can be used as an equalizer in a wetland environment, thereby preventing adverse drainage impact and allowing highway infrastructure to be built across water passages. Lining of the existing pipe is usually done if the pipe is in good shape/condition and the reduced flow capacity is acceptable. Previously, MTO utilized open cut construction to remove and replace existing drainage pipes. Rehabilitation of culverts with open cut technology involved detouring traffic off-highway or costly construction staging to permit the on-site flow of traffic. The existing water passages were dammed and excavation occurred at the project site as well as the surrounding highway. The original culvert was removed and a replacement installed with new granular compacted around the sides. Once re-covered, the pavement would be replaced to match existing highway conditions.

While open cut construction effectively replaced deteriorated culverts, local road detours required the cooperation of affected municipalities and MTO to investigate suitable detours and construction time. The staging and traffic management involved with open cut construction on a high traffic volume roadway is not generally preferable.

SLC enables the construction to be simplified with far less adverse effects on the surrounding environment. The existing culvert remains intact for suction cleaning, then a new pipe inserted and secured into the old. The cavity between the old and new form is blocked with grout and the water flow restored. A temporary trench may be dug into the backslope of the ditch to allow a level entry of the new culvert (**Figure 1**). In contrast to the necessary granular and new pavement for the highway, SLC requires no backfill or asphalt replacement after project completion, thereby preventing the risk of insufficient compaction or the risk of settlement. Construction occurs within 4-5 workdays with little impact on highway traffic flow, sensitive streams and fish habitats, and lowered use of aggregates or pavement. While the cross section of the pipe is reduced from inserting a replacement into the old steel pipe, the smooth lining material will usually maintain the flow capacity of the culvert (**Figure 2**).

Fig 1. HDPE liner inserted through temporary backslope on Highway 403.

Fig.2. Highway 403 culvert with plastic liner, prior to grouting operation.

There are different lining materials available, including steel liner, stainless steel liner, fiberglass and plastic. For the past decade, one of the products the ministry has used with success has been Weholite, a lightweight, high-density polyethylene (HDPE) closed profile wall pipe for sliplining roadway culverts. The HDPE pipes meet MTO material requirements for non-pressure polyethylene plastic pipe products, bringing corrugated steel pipe culverts to current safety standards on freeways and exceeding current standards on secondary highways. Weholite pipes are joined with the "Thread-Loc" joint, wherein corresponding male and female "Thread-Loc" ends are rotated into each other, eliminating the need for special equipment. HDPE pipes are chemically inert, corrosion and abrasion resistant and lightweight. The ministry has experienced lower installation costs, and lower transport costs. Full culvert replacement is considered only once the option of SLC is ruled out.

In 2006, Operational Services - London Area Office in Southwestern Region tendered a project for SLC of 8 culverts crossing Highway 403, west of Brantford. Alexman Contracting was awarded the contract using Terrafix Geosynthetics as a subcontractor to supply Weholite from KWH Pipe as the lining material. Approximately 202 metres of 36-inch diameter pipe was utilized on site. The September 2006 project was completed in one week, with cost savings on liner type, construction and restoration time. The ministry also experienced minimal traffic disruptions, repair costs, and the service life reduction normally associated with open cut construction. MTO's commitment to environmentally friendly innovation that meets or exceeds current standards has made sliplining the leading culvert maintenance technique. ■

For more information, contact Gordon Start, Operational Services, (519) 873-4219 or Gordon.Start@ontario.ca

Texas Detection Control System

MTO is currently undertaking a pilot project to test a new detection control system to improve the safety of rural high speed signalized intersections and reduce the incidence of red light infractions. Current advanced warning systems have not effectively addressed vehicles just entering or within the dilemma zone when the traffic light turns to amber, resulting in high-speed trucks running the red light. With participation from the Texas Transportation Institute (TTI), MTO installed the Texas Detection Control System (TDCS) at intersections in Northwest Region and Eastern Region in an effort to address concerns and evaluate the effectiveness of this unique technology.

Operational and safety concerns were identified at rural high-speed signalized intersections in Ontario. The ministry utilizes Advanced Warning Flashers to provide advanced information on the state of the traffic signals ahead to approaching drivers. Additional detection systems such as Long Distance Detection and Double Long Distance Detection system, which provide increased dilemma zone protection have not deterred red light running. Further more, existing detection systems would terminate the signal without regard to the number or type of vehicles approaching or within the dilemma zone.

TTI developed an Intelligent Detection Control System that enhanced MTO's Double Long Distance Detection System. The TDCS monitors cars and trucks approaching rural high-speed signalized intersections and determines the optimal time to end the signal phase. The system is able to classify a vehicle as it approaches a signalized intersection and determines the vehicle's speed, the occupied lane and the vehicle type.

Continuous communication occurs between the detection-control system components (**Figure 1**). The vehicle detection system detects vehicles speed, classification, and location via speed trap loops located in advance of the dilemma zone and sends a signal to an industrial computer running the algorithms which in turn communicates to the signal controller. The system is able to predict a dilemma zone for each vehicle approaching the intersection and predict whether the vehicle will proceed or be able to stop safely at the intersection, adjusting the signal display times accordingly. Customized software and hardware in the signal controller cabinet (**Figure 2**) will either end the green light before the driver enters the dilemma zone or hold the green light to allow drivers to clear the dilemma zone before turning red. The system will not end a green signal with trucks in the dilemma zone but will relax to allow one car within the dilemma zone.

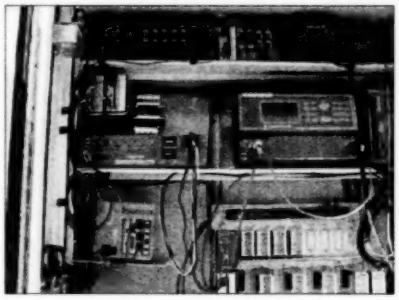


Fig 2. Equipment used in the traffic signals cabinet for the installation.

Previous field trials by TTI and Texas DOT found the TDCS reduced general red light violation by 53% and reduced truck red light violations a further 80%. In Spring 2006, MTO trial-tested the system at locations that would significantly benefit safety and operations. The TDCS was installed on Highway 17 at Round Lake Road and Doran Road in Pembroke (Eastern Region) and Highway 11/17 at Oliver Road in Thunder Bay (Northwestern Region). Dr. Karl Zimmerman of the TTI together with regional representatives from MTO participated in the installation. The study to evaluate of the detection system was awarded to Lakehead University under the Highway Infrastructure Innovation Funding Program (HIIFP). A final report is expected for August 2007 on the results of the Ontario in-field evaluation. Look to upcoming issues of Road Talk for comprehensive coverage. ●

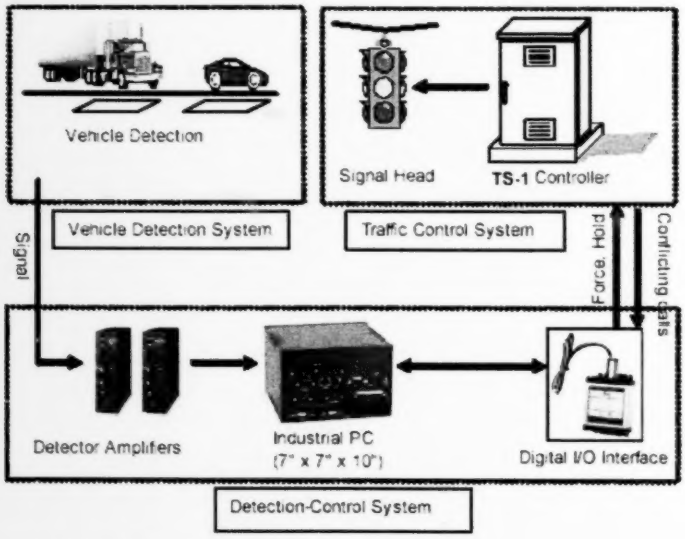


Fig 1. Interrelated detection-control system diagram

For more information contact
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This article originally appeared in the Spring 2007 Geotechnical News. It has been reprinted here with permission.

Geography

In 1994, Ministry of Transportation Ontario constructed a truck arrester bed at the north entrance to the City of North Bay. Thibault Hill, with an elevation change of about 100 m on the eastbound TransCanada Highway at the north entrance to the City is not an extremely steep or long hill: however, it has unique features that justified the choice of a truck arrester bed. It was hoped that the truck arrester bed would improve safety, as there have been several incidences (with one fatality) of trucks losing their brakes on the downgrade and failing to stop at traffic lights. The climate of North Bay is severe.

Arrester Bed Concept and Aggregate Characteristics

Low interparticle friction is needed so that the truck wheels sink deeper into the bed and as a result more energy is transferred. As the truck sinks into the bed, if the aggregate is of sufficiently low shear resistance, the axles will also drag on the upper surface further slowing the truck. The lower the interparticle friction, the more rapid the slowing of the truck.

It was recognized that in winter conditions, the contamination by ice control sand and water that might accumulate and freeze at the bottom of the bed would stop it functioning through the full depth. Theoretically, only a depth of 450 mm was required, although the bed was designed with a depth of about 600 mm with side slopes of 2:1 and a taper at the upper or entry end.

Aggregate having smooth rounded particles of substantially the same size with little or no sand or smaller or larger size particles is ideal. Another critical requirement is that the aggregate be resistant to both degradation by abrasion and freezing and thawing.

There are a number of characteristics that determine interparticle friction: sphericity, roundness, and surface texture. Gravel consisting of a high proportion of spherical particles will have a higher void space and lower internal friction thus giving a more efficient gravel arrester bed than one made with a low proportion of spherical particles.

In terms of roundness, there should be few or no fractured or crushed surfaces or sharp edges. Being rounded is not the same as being spherical. A cube has equal principle axis lengths and thus has a sphericity of 1, but such a particle is not going to have the desirable properties of roundness for use in a truck arrester bed.

Surface texture is determined by the grain size of the rocks and the degree of polish given by interparticle grinding. Grading is also important; poorly graded material preferably of a single sieve fraction is needed to reduce the stability of the material.

Aggregate Supply

Gravel sources within a radius of about 160 km were sampled and tested. Within any general area, only one or two sources were sampled because the nature of gravel within each of these areas was generally very similar. These sources are contained within glaciofluvial outwash, deltaic, and ice-contact deposits laid down ~ 10 to 12 thousand years ago during deglaciation. Clast types within these deposits are derived mainly from Precambrian igneous (e.g. granite, gneiss) and minor sedimentary (e.g. argillite, sandstone) rocks. Materials were tested for grading, shape, resistance to abrasion using the Los Angeles Petrographic Number, unit weight, and bulk relative density.

The samples from North Bay and Huntsville had the poorest shape because they contained the highest proportion of strongly foliated gneisses. The foliation gave the particles an elongated rather than cubical shape. The sample from Thessalon also had relatively poor shape due to the presence of the sedimentary rocks that often had a tabular shape.

The two MTO sources were of most interest. They were located within about 10 km of each other and had very similar geological composition; however, they were found in deposits of different glaciofluvial origins. The Deux Rivieres source was topographically lower than the Randon source by about 100 m and represented material from a relatively lower energy regime. The Randon source represented material that had been transported in a very high-energy environment. This was a coarse outwash deposit formed during a time of enormous water flow down the Ottawa River during the melting of glacial ice and discharge of water from glacial lakes.

Aggregate for Truck Arrester Beds

The Randon pit contained large rounded boulders (up to 0.5 m diameter) that could only be transported in a high energy environment. The Randon material had significantly better sphericity and rounding than any other source that was investigated. This was the material that was ultimately selected by the contractor for supply of the truck arrester bed gravel.

The supply of the arrester bed aggregate was governed by a special provision in the contract that specified the materials and defined the quality assurance process. After placement of material in the bed, it was to be covered to prevent the ingress of foreign materials during any subsequent construction work. Following production of material for the truck arrester bed from the Randon source, two series of tests were conducted to investigate the frozen strength of the aggregate.

Following installation of the truck arrester bed, full scale testing was made with a 4 axle, 20 tonne tractor-trailer combination owned by the Ministry of Transportation. The driver was highly experienced and wore a helmet. The trailer/truck combination was also fitted with anti-jackknife chains. The truck entered the bed at a variety of speeds and the bed performed as expected, stopping the truck in a short distance that increased as entry speed increased. Distance to full stop was measured. The rolling resistance was calculated as an average of about 0.25.

Laboratory Investigations of Frozen Strength

Following production of material for the truck arrester bed from the Randon source, two series of tests were conducted to investigate the frozen strength of the aggregate. As would be expected, there is a direct correlation between moisture content and strength; the more ice, the stronger the frozen material. For the

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» material to work as intended in winter conditions, it is necessary that the moisture content be as low as possible. This in turn is related to the ability to drain water and the cleanliness of the aggregate.

Runaway Truck

In September 2003, a truck entered the bed and became stuck as designed. It appears that the trucker had not heeded the warnings at the approach to the bed and pulled to the left to overtake a slower truck and entered the bed from the upper end. The materials were not frozen. It is not thought that the brakes had failed. As found in earlier testing, the tractor wheels became deeply embedded but the trailer wheels showed relatively little embedment and travelled in the grooves made by the wheels in front. ■

For more information and a video of the arrester bed in action, contact Chris Rogers, Manager, Soils and Aggregates Section (MERO) at 416-235-3739 or chris.rogers@ontario.ca

Look for "Friction Belt" Technology in a Future Issue of Road Talk!

Upcoming Conference Information

First International Conference on Recent Advances in Concrete Technology
September 19-21, 2007
Washington, DC

Transportation of Canada 2007 Annual Conference & Exhibition
October 14-17, 2007
Saskatoon, Saskatchewan

International Conference on Optimizing Paving Concrete Mixtures and Accelerated Concrete Pavement Construction and Rehabilitation
November 7-9, 2007
Atlanta, Georgia

TDM Summit 2007
November 25-28, 2007
Calgary, Alberta

...the CIR/CIREAM process can decrease GHG emissions by 50 to 60%...

Cold In-Place Recycled Expanded Asphalt Mix

A version of this article originally appeared in the November 2005 Road Talk. It has been updated.

Cold in-place recycling (CIR) is a environmentally friendly pavement rehabilitation method that grinds up an existing asphalt pavement, sizes it, mixes in a small amount of asphalt cement, and lays it back down without any off-site hauling and processing. The added asphalt cement is typically emulsified asphalt, a blend of asphalt cement and water droplets. The material is then profiled and compacted. A new surface of hot mix asphalt (HMA) is placed after the emulsion has set and moisture and compaction requirements have been met, which can take from 14 to 30 days. Application of CIR is usually limited to the warmer, drier months due to the use of emulsified asphalt.

A recent innovation in the CIR technology is Cold In-place Recycled Expanded Asphalt Mix (CIREAM). In this new process, hot asphalt cement is pumped through an expansion chamber on the cold recycling unit, where a small amount (1%) of cold water is injected and immediately vaporizes. This creates thousands of tiny bubbles within the hot asphalt cement causing it to rapidly expand (foam). Next, the expanded asphalt is mixed with the reclaimed asphalt pavement. As with conventional CIR, the material is then profiled and compacted. The major advantage of CIREAM over conventional CIR is that a new HMA surface layer can be applied following as short as a 2-day curing period, rather than the minimum of 14 days required for CIR. The process is also less dependent on warm, dry weather for placement.

CIR has been found to be an effective pavement rehabilitation treatment, mitigating reflective cracking and extending pavement life. By reusing existing aggregates and asphalt cement (a zero waste approach), CIR/CIREAM is both environmentally sustainable and cost-effective. Other benefits of using CIR/CIREAM can be illustrated by looking at Greenhouse Gas (GHG) emissions and aggregate conservation. When compared to a traditional roadway rehabilitation technique of milling and 130 mm HMA overlay, the CIR/CIREAM process can decrease GHG emissions by 50 to 60% and aggregate use by more than 60%.

Since 1990, the ministry has successfully carried out over 40 CIR contracts and more recently, three CIREAM contracts. As a result, the ministry has reduced carbon dioxide emissions by 54,000 tonnes, nitric oxide/nitrogen dioxide by 440 tonnes, sulphur dioxide by 9,400 tonnes and conserved over 740,000 tonnes of aggregate.

CIR/CIREAM technology is a sustainable alternative to conventional methods of pavement rehabilitation and allows the ministry to reduce GHG emissions in support of the Kyoto Protocol while addressing the triple-bottom-line: the Social, Economic, and Environmental (SEE) impacts of our decisions. ■

Cold in-place recycled expanded asphalt train consisting of hot asphalt tanker, milling unit, mixing unit, and paver.

For information, contact Becca Lane or Andrew Alkins, Pavements and Foundations Section, Materials and Engineering Research Office, (416) 235-3513.

continued from page 7

> material to work as intended in winter conditions, it is necessary that the moisture content be as low as possible. This in turn is related to the ability to drain water and the cleanliness of the aggregate.

Runaway Truck

In September 2003, a truck entered the bed and became stuck as designed. It appears that the trucker had not heeded the warnings at the approach to the bed and pulled to the left to overtake a slower truck and entered the bed from the upper end. The materials were not frozen. It is not thought that the brakes had failed. As found in earlier testing, the tractor wheels became deeply embedded but the trailer wheels showed relatively little embedment and travelled in the grooves made by the wheels in front. •

For more information and a video of the arrester bed in action, contact Chris Rogers, Manager, Soils and Aggregates Section (MERO) at 416-235-3739 or Chris.Rogers@ontario.ca

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Look for "Friction Belt" Technology in a Future Issue of Road Talk!

Upcoming Conference Information

First International Conference on Recent Advances in Concrete Technology
September 19-21, 2007
Washington, DC

Transportation of Canada 2007 Annual Conference & Exhibition
October 14-17, 2007
Saskatoon, Saskatchewan

International Conference on Optimizing Paving Concrete Mixtures and Accelerated Concrete Pavement Construction and Rehabilitation
November 7-9, 2007
Atlanta, Georgia

TDM Summit 2007
November 25-28, 2007
Calgary, Alberta

...the CIR/CIREAM process can decrease GHG emissions by 50 to 60%...

Cold In-Place Recycled Expanded Asphalt Mix

A version of this article originally appeared in the November 2003 Road Talk. It has been updated.

Cold in-place recycling (CIR) is a environmentally friendly pavement rehabilitation method that grinds up an existing asphalt pavement, sizes it, mixes in a small amount of asphalt cement, and lays it back down without any off-site hauling and processing. The added asphalt cement is typically emulsified asphalt, a blend of asphalt cement and water droplets. The material is then profiled and compacted. A new surface of hot mix asphalt (HMA) is placed after the emulsion has set and moisture and compaction requirements have been met, which can take from 14 to 30 days. Application of CIR is usually limited to the warmer, drier months due to the use of emulsified asphalt.

A recent innovation in the CIR technology is Cold In-place Recycled Expanded Asphalt Mix (CIREAM). In this new process, hot asphalt cement is pumped through an expansion chamber on the cold recycling unit, where a small amount (1%) of cold water is injected and immediately vaporizes. This creates thousands of tiny bubbles within the hot asphalt cement causing it to rapidly expand (foam). Next, the expanded asphalt is mixed with the reclaimed asphalt pavement. As with conventional CIR, the material is then profiled and compacted. The major advantage of CIREAM over conventional CIR is that a new HMA surface layer can be applied following as short as a 2-day curing period, rather than the minimum of 14 days required for CIR. The process is also less dependent on warm, dry weather for placement.

CIR has been found to be an effective pavement rehabilitation treatment, mitigating reflective cracking and extending pavement life. By reusing existing aggregates and asphalt cement (a zero waste approach), CIR/CIREAM is both environmentally sustainable and cost-effective. Other benefits of using CIR/CIREAM can be illustrated by looking at Greenhouse Gas (GHG) emissions and aggregate conservation. When compared to a traditional roadway rehabilitation technique of milling and 130 mm HMA overlay, the CIR/CIREAM process can decrease GHG emissions by 50 to 60% and aggregate use by more than 60%.

Since 1990, the ministry has successfully carried out over 40 CIR contracts and more recently, three CIREAM contracts. As a result, the ministry has reduced carbon dioxide emissions by 54,000 tonnes, nitric oxide/nitrogen dioxide by 440 tonnes, sulphur dioxide by 9,400 tonnes and conserved over 740,000 tonnes of aggregate.

CIR/CIREAM technology is a sustainable alternative to conventional methods of pavement rehabilitation and allows the ministry to reduce GHG emissions in support of the Kyoto Protocol while addressing the triple-bottom-line, the Social, Economic, and Environmental (SEE) impacts of our decisions. •

Cold in-place recycled expanded asphalt train, consisting of hot asphalt tanker, milling unit, mixing unit, and paver.

For more information, contact Becca Lane or Andrew Atkins, Pavements and Foundations Section, Materials and Engineering Research Office, (416) 235-3513.

Read All About It!

MTO Open House in Summary

On March 27th, 2007 Eastern Region and the Design and Contract Standards Office hosted the annual Maintenance Technology Project (MTP) Open House. The Open House provides an opportunity to see leading-edge technology, materials and equipment for winter operations in an operational setting, and observe how they support the project vision of ensuring that Ontario is a highway maintenance leader in effectiveness and efficiency.

Through partnerships between head office and regional offices, product manufacturers, vendors, and maintenance contractors, the Maintenance Technology Project strives towards four strategic goals:

- Protect the environment by reducing salt usage
- Move away from methods based specifications
- Improve operational and contract oversight
- Move towards outcome measuring and reporting

Spreading Equipment and Methods

MTO is committed to reducing the effects of salt on the environment. Our salt management plan ensures that salt is used efficiently and effectively, and requires all salt spreading trucks to be equipped with electronic salt management spreading controls. This technology helps to reduce waste and maximize the effectiveness of the materials used.

In addition to conventional salting, anti-icing is a strategy employed before a winter storm event to prevent black ice from forming and snow from bonding to the pavement surface. This is accomplished by applying winter road maintenance liquids directly to the road surface before the frost / black ice and winter storm. These liquids are also added to granular salt, to help it stick to the pavement and activate more quickly. This reduces the quantity needed and minimizes the impact on the environment.

The ministry is specifications for winter road maintenance liquids require them to be less corrosive than traditional road salt. Inhibitors added to the liquids reduce the corrosive effects on the vehicles and highway infrastructure that come into contact with them. This ministry is conducting field tests to determine the effectiveness of the corrosion reducing agents under field conditions.

For more information about RWIS, visit our Summer 2006 Road Talk and for more information about Winter Maintenance Corrosion Inhibitors, visit our Winter 2007 Road Talk.

Informational Systems

Maintenance operations rely on accurate and timely information regarding road and weather conditions before and during winter storm events. Some of the technologies showcased how MTO is improving the flow of condition reporting at the field level.

Road and Weather Information Systems (RWIS) are comprised of pavement and weather stations located in 113 locations across the province. They are designed to provide field offices with current and forecasted road and weather condition information to assist with winter operations decisions.

To protect road surfaces and foundations, load restrictions are placed on surface-treated highways in northern Ontario. These restrictions are imposed during the spring thaw when the highway surface or foundation is susceptible to road damage such as fatigue cracking by fully loaded trucks. Instrumentation at three field sites is being used to develop frost prediction models that can be used with RWIS forecasts to accurately determine when the spring load restrictions need to be imposed and when they can safely be removed.

An infrared camera mounted on a utility pole in Eastern Region is being evaluated for its ability to automatically detect and measure frost, snow and ice on the pavement surface. This system illuminates the surface with an infrared beam and measures the wavelength and intensity of light reflected back. This is used by the system to estimate the proportion and depth of material on the surface, and the traction level. It also provides a digital photo that is transmitted to a website used by maintenance staff for condition monitoring.

New Initiatives and Technologies

Many new technologies and research initiatives were also demonstrated, including electronic patrol diaries, Automated Vehicle Location (AVL) devices, experimental plow blade designs, as well as various friction-measuring equipment.

MTO is always looking for new technologies, tools and methods to improve winter maintenance operations, and the MTP project will help to ensure that our highways are as clear and safe as possible during inclement winter events. •

For more information, contact Max Perchanok, Research Coordinator, at (416) 235-4680 or Max.Perchanok@ontario.ca.

Reader Response

Got a great article idea for Road Talk?

Send us any ideas, comments, or suggestions concerning local innovations, workshops, or seminars that you would like to see included in future issues.

***Road Talk* is also available in French.**

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